REMARKS

Claims 1-32 remain pending in the application. Claims 1-3, 9, 12-14, 17, 20, 25-27, and 30-32 have been amended without introduction of new matter. Favorable reconsideration is respectfully requested in view of the following remarks.

Claims 9, 12-14, 17, 20, 27, and 32 have been amended merely to address several informalities that have just been noted. In particular, claims 9, 17, 27, and 32 have been amended to expressly state that the term "I-estimate" means "interference estimate." Support for these amendments can be found in the specification at, for example, page 4, line 7. The symbols used in the equations set forth in claims 12-13 and 20 have been expressly defined. Support for these amendments can be found in the specification at, for example, page 8, lines 31-32. The symbols used in the equation set forth in claim 14 have been expressly defined. Support for this amendment can be found in the specification at, for example, page 9, lines 11-20.

Claims 30-32 stand rejected under 35 U.S.C. §101 as allegedly being directed to non-statutory subject matter. This rejection is respectfully traversed.

According to the Office, claim 30's recitation of "computer-readable medium" "would reasonably be interpreted by one of ordinary skill in the art as software per se. ... Software is functional descriptive material and functional descriptive material is non-statutory subject matter."

Applicants respectfully disagree at least because the Office's interpretation of "computer-readable medium" in this instance is contrary to well-established U.S. patent practice. For example, the MPEP §2106.01 at page 2100-17 (Rev. 6, 2007) states "When functional descriptive material is recorded on some computer-readable medium, it becomes structurally and functionally interrelated to the medium and will be statutory in most cases since use of technology permits the function of the descriptive material to be realized." (Emphasis added.)

Claims 30-32 specifically define "A computer-readable medium containing a computer program for ..., wherein the computer program performs the steps of...." In this regard, the MPEP §2106.01 I, page 2100-18 (Rev. 6, Sept. 2007) further instructs, "[A] claimed computer-readable medium encoded with a computer program is a computer element which defines structural and functional interrelationships between the computer program and the rest of the computer which permit the computer program's functionality to be realized, and is thus statutory." (Emphasis added.)

For at least the foregoing reasons, the subject matter defined by claims 30-32 is believed to define statutory subject matter. It is therefore respectfully requested that the rejection of these claims under 35 U.S.C. §101 be withdrawn.

Claims 1, 4-14, 16 and 17-29 [sic: 17-25 and 27-29?] stand rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Tiirola et al (US 20040076132 -- henceforth "Tiirola") in view of Wang (US 20060154633). This rejection is respectfully traversed.

It is believed that the inclusion of claim 26 in the Office's stated list of claims subjected to this ground of rejection was made in error at least because claim 26 is not discussed in this part of the Office Action; thus, there is no support for such a rejection. This view is supported by the fact that claim 26 is specifically rejected based on a combination of Tiirola and Wang and further in view of Jokinen et al (US 6038238) (see below). The rejection of claim 26 is therefore traversed below in connection with that other ground of rejection.

The rejection of the remaining claims 1, 4-14, 16, 17-25 and 27-29 is traversed in the following.

The invention relates to methods and apparatuses for estimating interference in a terminal in a code division multiple access (CDMA) communication system, in which a pilot channel uses a scrambling code and the terminal uses an alternative scrambling code on a dedicated channel determined by a channelization code. As explained in the specification, beginning on page 3, line 22, good power control calls for the Signal-to-Interference Ratio (SIR) on the Dedicated Physical Channel (DPCH) to be estimated. The interference I, however, is typically estimated using pilot symbols transmitted on the Common Pilot Channel (CPICH), i.e., a channel with large signal strength, and then scaled to the DPCH interference. However, for reasons fully explained in the specification in the text spanning page 3, line 26 through page 6, line 19, this approach is deficient when alternative scrambling codes are used.

A conventional solution to this problem is to use the DPCH pilot symbols for both signal power (S) estimation and interference power (I) estimation, but this solution has problems. For example the I-estimate is noisy because the number of DPCH pilot symbols is small and the DPCH's overall signal power is small since the DPCH is power-controlled. The noisy I-estimate produces a noisy SIR estimate, and since the SIR estimate directly affects the average needed Base Station (BS) DPCH power, erroneously determining the

average power due to the noisy SIR estimate can reduce the system capacity. (See Applicants' specification at page 6, lines 20-26.)

Embodiments defined by independent claims 1 and 25 address this problem. As now amended, claim 1 defines "A method of estimating interference in a terminal in a code division multiple access communication system, in which a pilot channel uses a scrambling code and the terminal uses an alternative scrambling code on a dedicated channel determined by a channelization code, comprising the steps of: determining an empty channelization code m under the alternative scrambling code; if an empty channelization code m is determined, using the empty channelization code m for estimating the interference; and otherwise, estimating the interference by determining a variance of symbols in at least two portions of the dedicated channel."

Independent claim 25 has been similarly amended.

Support for "determining a variance of symbols in at least two portions of the dedicated channel" is found in the specification at, for example, original claim 2 and Figure 4 step 417 ("Estimate using DPCCH & DPDCH").

The subject matter defined by independent claims 1 and 25 is believed to be patentably distinguishable over any combination of Tiirola and Wang at least because neither of those references discloses or suggests "determining a variance of symbols in at least two portions of the dedicated channel." Further, neither reference suggests integrating two different interference estimation strategies into a single approach.

The Office rightly acknowledges that the Tiirola patent fails to disclose or suggest:

(a) determining an empty channelization code m under the alternative scrambling code; and

(b) using the empty channelization code m for estimating the interference.

Tiirola is further deficient, however, at least because it discloses determining a variance of symbols in only one portion of the channel, namely that portion containing pilot symbols. See, e.g., Tiirola at paragraph 0046 ("The dedicated pilot symbols are multiplexed into the down-link dedicated physical channel (DPCH). They are used in signal-to-interference ratio (SIR) estimation."); paragraph 0047 ("In accordance with the present invention, it is proposed to use the primary common pilot channel P-CPICH for estimating interference power in a mobile station ...."); paragraphs 0058 - 0063 (presenting an embodiment involving only pilot symbols); and paragraphs 0064 - 0069 (presenting an alternative embodiment involving only pilot symbols).

The Wang document fails to make up for the deficiencies of Tiirola at least because its interference estimation technique does not involve variance at all, but rather involves using an empty channelization code, as observed by the Office. Thus, even if the teachings of Tiirola and Wang were to be combined, the combination would still fail to support a *prima facie* case of obviousness because that combination would lack at least "estimating the interference by determining a variance of symbols in at least two portions of the dedicated channel" as defined by independent claims 1 and 25.

Moreover, it is respectfully contended that one skilled in the art at the time of Applicants' invention would not have been motivated to combine the teachings of Tiirola and Wang at least because each reference teaches a self-contained solution to the problem of interference estimation, without any teaching of the circumstances under which it would be preferable to do one or the other.

By contrast, Applicants have not only recognized that there are benefits to at times selecting one approach and at other times selecting the other, but have described and claimed embodiments in which using an empty channelization code m for estimating the interference is performed "if an empty channelization code m is determined" and "otherwise, estimating the interference by determining a variance of symbols ...."

For at least the foregoing reasons, the subject matter defined by independent claims 1 and 25 is believed to be patentably distinguishable over the prior art of record.

The various dependent claims 4-14, 16, and 27-29 inherit the features of their respective base claims 1 or 25, and are therefore patentably distinguishable for at least the same reasons as set forth above. Furthermore, these claims define additional features that are believed to be neither disclosed nor suggested by any combination of Tiirola and Wang.

For example, claim 6 defines the method "wherein the information of the empty channelization code m is included in a message sent to the terminal." The Office supports this aspect of the rejection by arguing that Wang discloses this feature in figure 10 and page 4, paragraph 0052. It is respectfully asserted that the Office has mischaracterized Wang because the cited portions of Wang disclose merely that "a low SF idle channelization code from the OVSF tree [is selected] using information regarding occupied channelization codes." However, not only does Wang's arrangement not transmit the information regarding empty channelization codes to the terminal, it would not do so because Wang's arrangement is specifically for enabling a *base station* to determine *uplink* interference estimation. (See, e.g., Wang at page 1, paragraph 0006.) Consistent with this purpose, Wang discloses a base

station, not a terminal, performing the functions (see, e.g., Wang at page 3, paragraph 0043: "...the estimated SINR for the desired code channel can be calculated as illustrated by the arrangement of FIG. 7, which illustrates the parts of a base station that are essential for explaining this exemplary embodiment of the present invention.") Moreover, Wang states that "The idle channelization code has been selected by an idle code selection block 28 based on the OVSF code tree in FIG. 2 and occupied codes *known to the base station*." (Emphasis added.)

Thus, in Wang, it is the base station that utilizes the empty code for interference estimation, and it is the base station that has knowledge of which codes are empty and which are used, so there is no need to communicate this information in a message. Further, the terminal (mobile station) would have no need for this information since Wang's process is carried out in the base station.

Dependent claims 9 and 27 define a respective method and apparatus wherein identifying the empty channelization code m involves:

> generating an initial interference estimate (I-estimate);
> setting a threshold based on the initial I-estimate;
> selecting a candidate empty channelization code;
> for the candidate empty channelization code, forming an I-estimate;
> comparing the formed I-estimate to the threshold; and
> if the formed I-estimate exceeds the threshold, selecting another candidate empty code and repeating the forming and comparing steps, otherwise identifying the candidate empty code as the empty channelization code.

The Office supports its rejection of these claims by alleging that "Wang in the same endeavor implicitly discloses in (fig. 7, a selector (28)) that searches for and selects an idle channelization (see abstract, and page 3, [0043]-[0046])." With all due respect, this allegation is wrong because not only are the claimed steps/elements not inherently disclosed by Wang, it would not make sense for them to be disclosed. As explained above, Wang discloses a base station that performs uplink channel estimation. As expressly stated in paragraph 0043 of Wang, which codes are occupied and which are not "are known to the base

station." It is therefore completely unnecessary for the base station to go through a process of testing received signals to explore and find an empty channelization code.

By contrast, Applicants' claimed methods and apparatuses are expressly stated as being for "estimating interference in a terminal" (emphasis added). Unlike a base station (which serves all the terminals in its cell), the terminal inherently knows only the codes that it is using; of relevance here is that the terminal does not have information about what codes other terminals may or may not be using. For this reason, Applicants' have devised, and now claim, a technique that enables the terminal to test candidate channelization codes to find out whether they are in use or not (i.e., empty).

Considering now independent claim 17, it defines:

> A method of searching for an empty channelization code m in a terminal in a code division multiple access communication system, comprising the steps of:
>
> generating an initial interference estimate (I-estimate);
>
> setting a threshold based on the initial I-estimate;
>
> selecting a candidate empty channelization code m;
>
> for the candidate empty channelization code m, forming an I-estimate;
>
> comparing the formed I-estimate to the threshold; and
>
> if the formed I-estimate exceeds the threshold, selecting another candidate empty channelization code and repeating the forming and comparing steps, otherwise identifying the candidate empty channelization code m as an empty channelization code.

It is noted that the Office relies solely on Wang in support of its rejection of this independent claim. Since the Office argues that these features are "implicitly" disclosed in Wang, Applicants first submit that the ground of rejection of this claim is improper: Wang appears to have been rejected as allegedly being anticipated by Wang, rather than being allegedly unpatentable over a combination of Tiirola and Wang.

Moreover, neither Tiirola nor Wang discloses the claimed features. The Office rightly acknowledges that Tiirola is silent with respect to the subject matter of claim 17, but argues

that "Wang in the same endeavor implicitly discloses in (fig. 7, a selector (28)) that searches for and selects an idle channelization (see abstract, and page 3, [0043]-[0046])."

In response, it is observed that the subject matter defined by claim 17 is included also in dependent claims 9 and 27. Therefore, the arguments set forth above with respect to claims 9 and 27 are applicable (and incorporated) here as well. In short: Wang discloses a base station performing uplink interference estimation, not a terminal performing downlink interference estimation. Since the base station is the source of the knowledge of which codes are used and which are not, there would be no purpose in performing the candidate code testing technique claimed by Applicants.

For at least the foregoing reasons, it is respectfully asserted that the subject matter variously defined by independent claims 1, 17, and 25, as well as by their various dependent claims 4-14, 16, 18-24, and 27-29 is patentably distinguishable over the prior art of record. Accordingly, it is respectfully requested that the rejection of these claims under 35 U.S.C. §103(a) be withdrawn.

Claims 2-3, 15, and 26 stand rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Tiirola in view of Wang and further in view of Jokinen et al. (US 6038238 -- henceforth "Jokinen"). This rejection is respectfully traversed.

Claims 2-3, 15, and 26 variously depend from independent claims 1 and 25, and are therefore patentably distinguishable over any combination of the Tiirola and Wang documents for at least the reasons set forth above. Jokinen fails to make up for the deficiencies of Tiirola and Wang, so that any combination of these three would still lack at least:

- "estimating the interference by determining a variance of symbols in at least two portions of the dedicated channel". (Emphasis added.)

Further, the Office acknowledges that Tiirola and Wang fail to disclose determining whether the communication system is using discontinuous transmission (DTX), but relies on Jokinen as making up for this deficiency. In this respect, the Office argues that "Jokinen et al. ... discloses in (fig. 4), a method to realize discontinuous transmission (DTX) in a telecommunications network (col. 5, lines 20-36)" and that it would have been obvious "to utilize the method of Jokinen et al in the method of Tiirola et al as modified by Wang .. to

reduce co-channel interference and its effect on the communication quality (col. 1, lines 16-18)."

It is respectfully asserted that the Office's argument does not support its rejection because it merely states that one would use DTX while at the same time performing interference estimation.

However, Applicants' claims do not define using DTX. Rather, they qualify the claimed method by stating that "determining the variance of symbols in at least two portions of the dedicated channel is performed only after first determining that the communication system is *not* using discontinuous transmission (DTX)." (Emphasis added.) Support for this feature can be found in the specification at, for example, Figure 4, steps 413 and 417 (in which both DPCCH and DPDCH are used only when DTX mode is not in use).

Jokinen is silent with respect to interference estimation, and therefore cannot suggest a terminal basing its interference estimation technique on whether DTX is in use. Tiirola is silent with respect to this feature because Tiirola uses only a single portion of the channel (i.e., pilot symbols) in its technique, and therefore does not need to detect whether symbols are present in another portion. (Pilot symbols are always present regardless of whether DTX is in use.) Wang's interference technique involving unused channelization codes similarly has no need for knowledge of whether DTX is in use.

For at least the foregoing reasons, it is respectfully asserted that the subject matter defined by claims 2-3, 15, and 26 is patentably distinguishable over the prior art of record. Accordingly, it is respectfully requested that the rejection of these claims under 35 U.S.C. §103(a) be withdrawn.

Claims 30-32 stand rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Tiirola in view of Wang and further in views of Langberg et al. (US 5852630 -- henceforth "Langberg"). This rejection is respectfully traversed.

As now amended, independent claim 30 defines:

> A computer-readable medium containing a computer program for estimating interference in a terminal in a code division multiple access communication system, in which a pilot channel uses a scrambling code and the terminal uses an alternative scrambling code on a dedicated channel determined by a channelization code, wherein the computer program performs the steps of:

determining an empty channelization code m under the alternative scrambling code;

if an empty channelization code m is determined, using the empty channelization code m for estimating the interference; and

otherwise, estimating the interference by determining a variance of symbols in at least two portions of the dedicated channel.

(Emphasis added.)

Support for "determining a variance of symbols in at least two portions of the dedicated channel" is found in the specification at, for example, original claim 2 and Figure 4 step 417 ("Estimate using DPCCH & DPDCH").

It is noted that the steps performed by claim 30's computer program embodied on the computer-readable medium correspond to those defined by method claim 1. Therefore, the subject matter defined by claim 30 is patentably distinguishable over any combination of Tiirola and Wang for at least the same reasons as those set forth above. Langberg fails to make up for the deficiencies of Tiirola and Wang, so that any combination of these three documents would still lack at least:

- "estimating the interference by determining a variance of symbols in at least two portions of the dedicated channel". (Emphasis added.)

Langberg discloses a method and apparatus for a RADSL Transceiver warm start activation procedure with precoding, and has nothing to do with interference estimation. The Office does not argue to the contrary, but merely relies on Langberg for its teaching that "the method and apparatus ... can be implemented in software stored in a computer-readable medium."

For at least the foregoing reasons, it is respectfully asserted that the subject matter defined by independent claim 30 and its dependent claims 31-32 is patentably distinguishable over the prior art of record. Accordingly, it is respectfully requested that the rejection of these claims under 35 U.S.C. §103(a) be withdrawn.

The application is believed to be in condition for allowance. Prompt notice of same is respectfully requested.

Respectfully submitted,

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